Digitized by the Internet Archive
in 2016

https://archive.org/details/cornwallfurnacea21grit

GEN

ALLEN COUNTY PUBLIC LIBRARY
3 1833 01850 7993

GC
974.801
L49L,
V.2,
NO.1

ALOGY DEPT.
V 2 5 2002
unty Public Library

Cornwall Furnace

..And..

The Cornwall Ore Banks,

Or Mine Hills.

SITUATE AT CORNWALL, LEBANON COUNTY, PENNA.

PAPER READ BEFORE THE
LEBANON COUNTY HISTORICAL SOCIETY,
FEBRUARY 20, 1901,

—BY—

HENRY C. GRITTINGER.

VOL. II. No. 1.

Site of the First Bloomery or Experimental Furnace Erected at Cornwall, Penna., about the year 1739.

The Early Manufacture and Uses of Iron.

Iron in its various forms and combinations, although called one of the "baser metals," has proved to be one of the most valuable of nature's gifts to mankind.

When or by whom it was first put to use, is a matter of mere conjecture, as no authentic account of its discovery can be found.

The first record of anyone being engaged in the manufacture occurs in the Bible in the fourth chapter of the Book of Genesis, which refers to Tubal Cain, who was of the seventh generation from Adam, as having been "An Instructor of every artificer in brass and iron."

That its value and uses were appreciated, is evident from the spreading of the knowledge of its manufacture to the countries adjoining Judea, where it is supposed to have originated, and gradually thence to all parts of the world. Owing possibly to its rarity or probably difficulty in manufacture, it was first treated as a precious metal, and ornaments of bronze and iron have been found in the ruins of Ninevah and ancient Egyptian Tombs and Temples, in proof of this.

A recent account of the explorations at Nippur in the Euphrates Valley, that are now being made by Prof. Hilprecht of the University of Pennsylvania, states that no implements made of iron have thus far been discovered in the ruins of that city.

The inhabitants of India, China and other countries of the far East were all early and expert manufacturers of iron, and it is stated that in ruins of Ancient Temples in India, wrought iron beams have been found measuring 24 feet in length and 8 inches in section.

The famous cylindrical wrought iron pillar at the mosque of the Cuttub Shaw near Delhi in India, supposed to have been erected at the beginning of the Christian Era, is said to be a most wonderful piece of workmanship both on account of its size, as well as of its ornate character. It is 60 feet in height, with its lower diameter 16½ inches and its upper 12 inches, and contains upwards of 80 cubic feet of metal and weighs about 17 tons.

How such a forging could have been made with the appliances then in use, is a mystery, as there are but few of the latest improved modern iron plants that would be able to duplicate it.

There are no authentic accounts of the introduction of the manufacture of iron into European countries, although the Ancient Greeks attributed its discovery to the burning of the forest on Mount Ida, in Crete, about 1500 years B. C., whereby native ores on the Mount were reduced to metallic iron. Its manufacture and use must have gradually become general, as Homer, in recounting the wanderings of Ulysses in the Odyssey, which was written about 850 years B. C., makes frequent mention of iron and its uses, and describes the art of hardening or tempering steel, in likening the effect of Ulysses' plunging the fire-brand into the eye of Polyphemus, the Cyclop giant, to the act of the smith who "dips into cold water a great axe, and it hisses loudly as he is tempering it, for so it is that iron is made hard." Lycurgus, who lived about a century later, and who, by the way, must have been "the original monometallist," is said to have retired gold and silver as a circulating medium, and to have substituted bar iron or iron rings or quoits in place of it.

As the years advanced, the uses of iron became enlarged, and tools, agricultural implements and weapons of offense and defense were manufactured from it.

Its manufacture from the ores was also gradually improved as the art spread to the western and northern portions of Europe.

The methods used, however, were all very crude and primitive, consisting of low stacks, built of clay or excavated in a hillside, with openings at the bottom either for a natural draft, or for an artificial blast that was forced into the furnace by means of small bellows made of skins.

This form of a furnace is still used in parts of India and the far East, and is usually built from 3 to 6 feet high, and from 10 to 18 inches in diameter. The furnace is charged alternately with charcoal and ore, until filled, and after a blast of from 8 to 12 hours, or longer, the spongy mass of soft malleable iron mixed with some cinder, is removed from the furnace, usually by breaking away a portion of the lower part of the stack, and while still hot, is hammered. It is reheated and hammered again and again, until the cinder is expelled and the iron is comparatively pure.

About the tenth century of the Christian Era, these methods were superseded by the Catalan Forge or Bloomery, which originated in Catalonia, Spain, from which were developed built up furnace stacks from 10 to 16 feet in height, called in Styria, "Stuckofen or Wolfofen," the walls being built of stone and lined with a refractory material.

They were operated in the same manner as the smaller furnace just described, but yielded a mass or lump of malleable iron weighing fully ten times as much, and necessarily required a larger and more powerful bellows, as well as larger hammers, which were usually operated by water power.

These stacks were further improved from time to time, up to the 14th Century, when they were succeeded by the "Flussofen or Blaseofen" that were 25 feet in height, and kept in continuous operation, the molten iron being tapped at intervals as is done at the present time, in modern blast furnaces.

These were the first true blast furnaces, but they received little development or had few improvements made to them during the next four centuries, excepting possibly a small increase in size.

The iron manufactured up to about the 14th Century was principally in the form of hammered iron and steel.

However, after the building of the Flussofen, in which a higher degree of heat was attained, a larger quantity of molten iron was made in the furnaces, and the manufacture of small casting was then begun.

It is recorded that cast iron cannon were first made near Erfurt, in Thuringia, about the year 1377, but they had been in use in England and France in the beginning of that Century, and in the 15th Century pots, plates, balls, &c., were cast in other portions of Germany, and stoves were cast for the first time in Alsace, in 1490.

Steel as a merchantable commodity in England is first mentioned in the early part of the 13th Century, although its manufacture as refined and hardened iron was known long before the Christian Era,—the celebrated swords of Damascus and the Blades of Toledo bearing witness to the skill of the older nations of both Asia and Europe, in its manufacture.

At the time of the founding of the Colonies in America, the manufacture of iron in Europe was flourishing, but was limited by the requirements of the people, principally to wrought or hammered iron, although castings and steel were also made.

The First Manufacture of Iron in America and in Pennsylvania.

The first discovery of iron ore in America by Europeans is reported to have been made in 1585, in North Carolina, by an expedition fitted out by Sir Walter Raleigh, although no iron was made in that Colony until late in the 18th Century.

In 1608, the English Settlers, who had founded the Colony at Jamestown, Virginia, sent a quantity of iron ore to England, which was smelted and produced metal that was pronounced to be of a superior quality.

In 1621–22, an attempt was made to set up a number of iron works in Virginia, on Falling creek, a tributary of the James river, in what is now known as Chesterfield county, about 7 miles below the city of Manchester, but they resulted in failure, and the buildings erected were destroyed by the Indians and all but one of the 348 employees and their families were slain, and no further effort was made in that direction, until the beginning of the 18th Century.

The first discovery of iron ore in New England, was made near Lynn, Massachusetts, in 1629, and in 1643, John Winthrop, Jr., came from England with capital and workmen, and erected a plant to manufacture iron on the west bank of the Saugus river. This plant proved to be a success, and yielded about eight tons of iron per week, and it is claimed that "it was the first which was established in America."

The next iron works in America were built in Shrewsbury, in New Jersey, about the year 1676, by Col. Morris.

Pennsylvania was the next province to begin the manufacture of iron, the first mention of its discovery having been made in a composition written in rhyme by Richard Frame, entitled "A Short Description of Pennsylvania," that was published by William Bradford, in Philadelphia, in 1692.

The Poem was descriptive of the beauties of the Province, and mentioned many of its products, and in speaking of iron, says,

"A certain place here is, where some begun
To try some Mettle and have made it run,
Wherein was Iron absolutely found,
At once was known about some Forty Pound."

As no reference is made to the locality in which the iron was made, it must be left to imagination, although it is quite likely that it was in one of the eastern counties of the Province, and was made in the primitive manner heretofore described, or in an ordinary blacksmith fire.

Although William Penn, the Proprietor of the Province, who also owned iron furnaces at Hawkhurst, in England, was extremely anxious to have its mineral resources developed, having, as early as 1683, written of the existence of "Mineral of Copper and Iron in divers places," in Pennsylvania, and again in 1702, he wrote from London to James Logan, his secretary, at Philadelphia, urging him to call on certain parties who had proposed to develop these minerals, there is no record of the successful manufacture of iron on a commercial scale, until the year 1716.

Mr. Swank in his work on "Iron in all Ages" states that "Mrs. James, in her Memorial of Thomas Potts, Jr., in referring to this says, the event, which occurred in 1716, is briefly described in one of Jonathan Dickinson's Letters, written in 1717, and which we have seen, viz:—'This last summer, one Thomas Rutter, a smith, who lives not far from Germantown, hath removed further up the country, and of his own strength has set upon making iron. Such it proves to be, as is highly set by, by all smiths here, who say that the best of Sweed's iron doth not exceed it; and we have accounts of others who are going on with iron works.'"

The United Brethern Church in Lebanon County. Illustrated. By Rev. C. I. B. Brane, D. D. - 203
State Roads and Highways in Eastern Pennsylvania and Lebanon County. By Hon. Theodore B. Klein. - - - - - - - - - 253
The Episcopal Church in Lebanon County. Illustrated. By Rev. Alfred M. Abel. - - - - 274
The Mills of the Quittapahilla. Illustrated. By Henry S. Heilman. - - - - - - - 293
The Pennsylvania-German and His English and Scotch-Irish Neighbors. By Prof. M. D. Learned, Ph. D. 315
The Educational Work of Lebanon County. By Rev. H. U. Roop, Ph. D. - - . - - 330
Jacob Weidle—A Biographical Sketch. By Hon. Jacob Weidle. - - - - - - - - - 337
In Memoriam—William Coleman Freeman. - - 342
St. Mary's Catholic Church, Lebanon. By Rev. Adam Christ. - - - - - - - - - 344
Lebanon County in our State Legislature, By Hon. E. Benjamin Bierman, Ph. D. - - - - 351
The Annville Academy. Illustrated. By Prof. Hiram H. Shenk. - - - - - - - 399
List of Members, December 31, 1904. - - - 434

agent of William Penn, and Joseph Turner and William Allen, who had been the first owners of the Cornwall Ore Banks and the adjoining lands, under the Warrant of the Proprietaries.

The next enterprise consisted of a blast furnace and a forge that were erected on Christiana creek, in New Castle county, Delaware, in 1725, by Sir William Kieth, then Governor of the Province.

In 1728, the iron industry of Pennsylvania appeared to be in a flourishing condition, there being four blast furnaces in in operation, besides a number of forges. The output of a blast furnace in those days, being limited to about two tons of pig iron or castings per day. During the year 1728-29, the Province exported 274 tons of pig iron to England.

Quite a number of furnaces and forges were erected along the Schuylkill Valley, at intervals, during the next fifteen years, notably among which were McCall's, afterward called "Glasgow Forge," on the Manatawny creek, a short distance above where Pottstown now stands, in 1725, by George McCall; "Spring Forge" on the Manatawny, in 1729, by Anthony Morris; "Green Lane Forge" on Perkiomen creek, in Montgomery county, in 1733, by Thomas Maybury; "Mt. Pleasant Furnace" on the Perkiomen creek, in 1738, by Thomas Potts, Jr., who also erected a forge called by the same name, in 1743; "Pine Forge" on the Manatawny creek, about five miles northwest of Pottstown, in 1740, by Thomas Potts, Jr.; "Oley Forge" also on the Manatawny, in Berks county, in 1744, by John Ross, John Yoder and John Lesher.

In 1738, another blast furnace was erected on the south branch of French creek, and was called "Warwick Furnace."

Here the celebrated Franklin stoves were first made; a model of the stove having been presented to Robert Grace, the proprietor of the furnace, by Benjamin Franklin, the inventor. An account of the venture, published at the time, states, "that the casting of these plates proved to be quite profitable, as they were growing in demand."

Warwick Furnace was one of the most prominent furnace plants in Pennsylvania, previous to and after the beginning of

The plant here referred to was a bloomery forge, and was located on the Manatawny creek, about 3 miles northwest of Pottstown, Pa., and was known by the name of "Pool Forge."

The word Bloomery is said to be of Saxon origin; the word "Blooma" from which it is derived, meaning a mass or lump, and the term "Bloom" is applied to the square shaped piece of iron, after it has passed from the forge hammer.

Another reason given as to why the mass of iron is called a bloom, is on account of the glowing color or bloom, to which it is necessary to heat it before placing it under the forge hammer.

The bloomeries that were in use at that day being very similar to the Catalan forge that were in use in Europe as early as the 10th Century, already referred to, and were not unlike a large blacksmith fire, with a deep fire pot, in which the blast was introduced at the side, instead of at the bottom of the fire, and while yielding but a limited output per day, they were used on account of the small expense and labor involved in their erection.

Samuel Nutt is credited with building the next plant, which was erected on French creek, in Chester county, in 1717. This was also a bloomery, and was called "Coventry Forge."

The first blast furnace erected in Pennsylvania was called "Colebrookdale Furnace," and was the next enterprise.

It was located on Ironstone creek, in what is now Colebrookdale township, in Berks county, and was erected in 1719–20 by a company, of which Thos. Rutter, of Pool forge, was the principal member. It supplied Pool and other forges in the neighborhood with pig iron.

In 1720, Samuel Nutt, who had previously erected Coventry Forge, also built a blast furnace on French creek, which he called "Redding Furnace."

Durham Furnace, on the Delaware, in the northeastern part of Bucks county, was the next enterprise. It was built in 1727, by a Company of Philadelphians, among whom were James Logan, who was the private secretary and financial the 19th Century, it having been engaged quite extensively in making cannon, shot and shells for the use of the Continental Army, during the Revolutionary War, besides making kettles, salt pans and other castings,—it having been credited with having furnished 60 cannon in 1776.

This brings us up to the period of the building of the first furnace plant at Cornwall, which, by the way, was also the first iron manufactory erected in what is now known as Lebanon county.

The First Manufacture of Iron at Cornwall.

Mr. Swank, in his History of Iron Making in Pennsylvania, says, "Cornwall Furnace, located within the limits of the now celebrated Cornwall Ore Hills, on Furnace creek, in Lebanon county, a few miles south of Lebanon, was built in 1742, by Peter Grubb, whose descendants to this day have been prominent iron-masters. He was a son of John Grubb, a native of Cornwall, in England, who emigrated to this country in 1692, landing at Grubb's Landing on the Delaware, near Wilmington, at which latter place he is buried."

In a letter to the writer, under date of Feb. 28, 1900, in reply to inquiries, Henry B. Grubb, Esq., of Burlington, N. J., a great, great grandson of Peter Grubb, says, "Peter Grubb was the youngest son of John Grubb, who took up land on the Delaware, where Chester now is, in 1679, coming from Cornwall, England, shortly before. Peter was born at Marcus Hook, 1707,-8, and died 1754. I think the date 1742, for the building of Cornwall Furnace, the most correct—that is to say the first blast. It may have been some years in building."

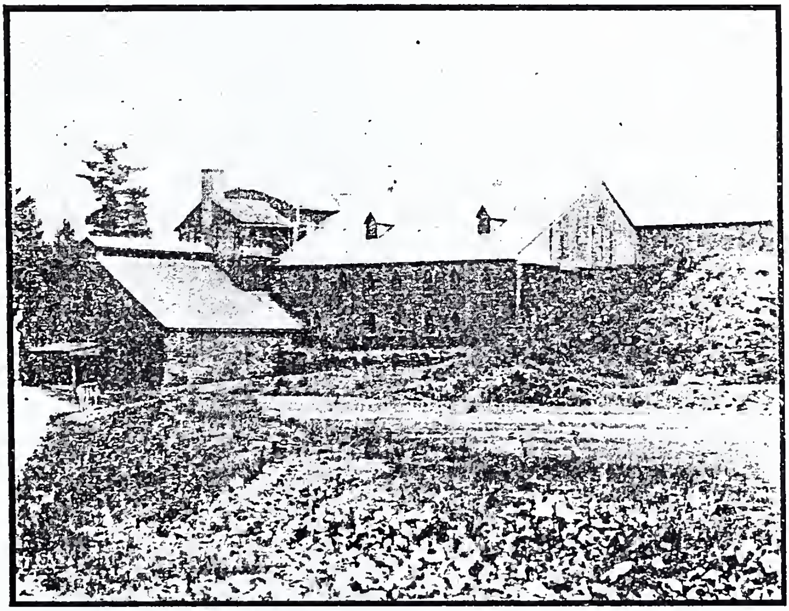
Mr. Swank further says, "There is record evidence that Peter Grubb was already an iron-master before he built Cornwall Furnace, as a tradition in his family says, 'that in 1735 he built a furnace or bloomery, most likely the latter, about five-eighths of a mile distant from the site of Cornwall Furnace.' "

Evidences that a small experimental furnace or bloomery had been built at one time, a short distance east of what is now called Miners' Village, can still be found.

The site, which is about a mile from Cornwall Furnace, was pointed out some time ago to the writer, by Mr. J. Taylor

Boyd, Superintendent of Cornwall Ore Banks, who stated that it was shown to him by an old resident when he first came to Cornwall, about the year 1853, as being the place that tradition had located the first furnace erected at Cornwall.

The writer found some evidence of the correctness of the tradition, in the shape of small pieces of slag and several pieces of white iron,—one of which has been presented to our Society, as "a sample of the first iron made in Lebanon county." That the furnace or bloomery was an experimental affair, is evident from the fact that it was located on the bank of a small spring run, that was entirely too insignificant to furnish water power to run the bellows, which in all probability was worked by hand. The location, too, is narrow and confined in a ravine, and no indications that buildings had been erected, can be found.



VIEW OF CORNWALL FURNACE, 1901.

It is doubtful, however, whether it was built by Peter Grubb, for the reason that in 1739 he leased the Cornwall ore lands to Samuel Grubb and Joseph Taylor.

In this lease Peter Grubb is styled an "iron-master," and it says "that he intends to build an iron furnace" on land adjacent to that leased to Samuel Grubb and Joseph Taylor. This proposed furnace was undoubtedly Cornwall Furnace, erected in 1742, and it is the belief of the writer that the experimental plant before referred to was built by Samuel Grubb, as on May 19th, 1744, he took out a Warrant for a tract of land embracing the site on which this plant was erected, and afterwards sold it to Peter Grubb, who then owned the adjoining tract on which Cornwall Furnace is now located.

Peter Grubb may have acquired the title of "iron-master" from the fact that he took up a tract of 171 acres of land on what is now called the Hammer creek, about 6 miles southeast of Cornwall, on the 4th day of April, 1737.

Here he built the two "Hopewell Forges;" but at what time is not known. He may have, however, built one of them shortly after, or even before taking up the land, and run it as a bloomery or Catalan forge, bringing the ore from Cornwall for that purpose, and no doubt the location was chosen on account of the water power furnished by the Hammer creek, which was the largest stream in the neighborhood.

Both Cornwall Furnace and the experimental plant referred to were located near the old road that had been the original thoroughfare through the southern part of what is now known as Lebanon county, between Harris' Ferry and Philadelphia. On some of the old maps of the Cornwall estate this road is called "The Paxton Road," and the writer was informed years ago, by Mr. Jas. P. Jackson, who was then Manager of Cornwall Furnace, that tradition had it, that the name had been applied locally to the road, because "The Paxton Boys" had marched over it on their way to Philadelphia, at the time of their insurrection in February, 1764.

Since that time, portions of the road have been changed,—parts being abandoned and others substituted,—the greater portion of the thoroughfare to Philadelphia having been occupied by the Downingtown, Ephrata and Harrisburg Turnpike Road.

The road is an ordinary public road at present, the charter of the turnpike company having been annulled in Lebanon county.

Acrelius in his history of New Sweden, written in 1756, states the following, in reference to Cornwall, or Grubbs Iron Works in Lancaster county: "The Mine is rich and abundant, forty feet deep under the earth's surface. This ore is somewhat mixed with sulphur and copper. Peter Grubb was its discoverer. Here there is a furnace which makes twenty-four tons of iron a week, and keeps six forges regularly at work,—two of his own, two belonging to Germans in the neighborhood, and two in Maryland.* The pig iron is carried to the Susquehanna river, thence to Maryland, and finally to England. The bar iron is sold mostly in the country and interior towns, the remainder in Philadelphia. It belongs to the heirs of the Grubb estate, but is now rented to Gurrit & Co."

In speaking of the yield of iron in a general way, Acrelius states, "That a good furnace yields from twenty to twenty-five tons weekly, on an average, for the whole time they are in blast. Also, that in the year 1753, Reading forge gave eight hundred and fifty tons, and Warwick seven hundred and twenty tons of bar iron. One forge, with three hearths in good condition and well attended to, is expected to give two tons a week, and a clear profit of £16, 12s., 8d., sterling."

Of the workmen employed, he says, "The workmen are partly English and partly Irish, with some few Germans, though the work is carried on after the English method. The pig iron is smelted into 'geese' ('gœsar'), and is cast from five to six feet long and a half foot broad, for convenience of forging, which is the Walloon style. The pigs are first operated upon by the finers (smelters). Then the chiffery or hammer-men take it back again into their hands, and beat out the long bars. The finers are paid 30s. a ton, the hammer-men 23s., 9d., per ton, that is to say, both together, £2, 13s., 9d. People are so generally acquainted with the process of making iron that it is not necessary to describe it here.

---

* The two belonging to Germans in the neighborhood, were Quittapahilla, afterward called New Market Forge on the Quittapahilla creek, and Charming Forge on the Tulpehocken creek.

"The laborers are generally composed partly of negroes (slaves), partly of servants from Germany or Ireland bought for a term of years. A good negro is bought for from £30 to £40 sterling, which is equal to 1500 or 2000 of our dollars koppar mynt. Their clothing may amount to 75 dollars k. mt., their food 325 ditto—very little, indeed, for the year. The negroes are better treated in Pennsylvania than anywhere else in America. A white servant costs 350 dollars k. mt., and his food is estimated at 325 more, of the same coinage.

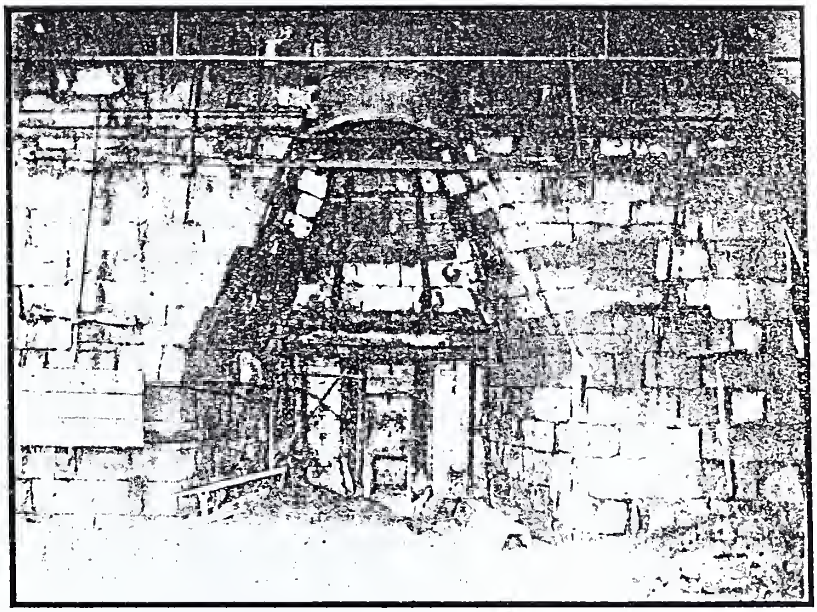
"For months in the summer when the heat is most oppressive, all labor is suspended at the furnaces and forges.

"The wood in the country is very abundant, and will not be readily exhausted, as it grows rapidly, although it does not live long. Charcoal from the hickory is used as the best, next to this that of ash and white oak, but still more of black oak, as that is most abundant and can best be spared. The country is everywhere cut through by running streams, which are in many places navigable, and waterfalls are not difficult of passage.

"Iron ore in Pennsylvania is more abundant than the people will ever make use of. On the best ground for farming are found stones which contain some iron, of which the rain washes out particles, which are seen in long streaks along the public highroads. The Delaware river, which receives so much running water, throws up, during storms, black iron sands upon the strands, so that a great quantity of it can be gathered up, which is attracted by a magnet, and is only used as writing-sand.

"Pig iron is sold at the furnaces for from £3, 6s., 8d., to £3, 10s., per ton. Bar iron at the forge brings £20 per ton, or 20s. per 100 pounds. It is sold dear, for six months' credit is given. Pig iron is sold in Philadelphia at £5 per ton; bar iron, in large quantities, at from £14 to £16 per ton. It certainly seems remarkable that the price is diminished after the long transportation to the city, but in this people find their profit.

"The iron works of Pennsylvania lie mostly within forty miles of Philadelphia. The carriage for such a distance does not exceed twenty shillings sterling per ton. As a set-off to this is reckoned the return-freight upon goods serviceable for the store-house of the works.



VIEW OF FRONT ARCH OR FOREPART OF CORNWALL FURNACE, 1901.

"Mr. Allen's calculation of expenses is: Pay for the labor for the manufacture of the iron from pig iron into bar iron £2, 3s., per ton. Pig iron at the furnace cannot cost the proprietor of the works more than £2 per ton. Bar iron costs at the forge £10 per ton. Bar iron is sold in the country places at from £19, 6s., 8d., to £20 per ton. In Philadelphia at £15 per ton. In London at from £16 to £17 per ton. In the West India Islands at from £17 to £18 per ton. Pig iron is sold in Philadelphia at £5 per ton.

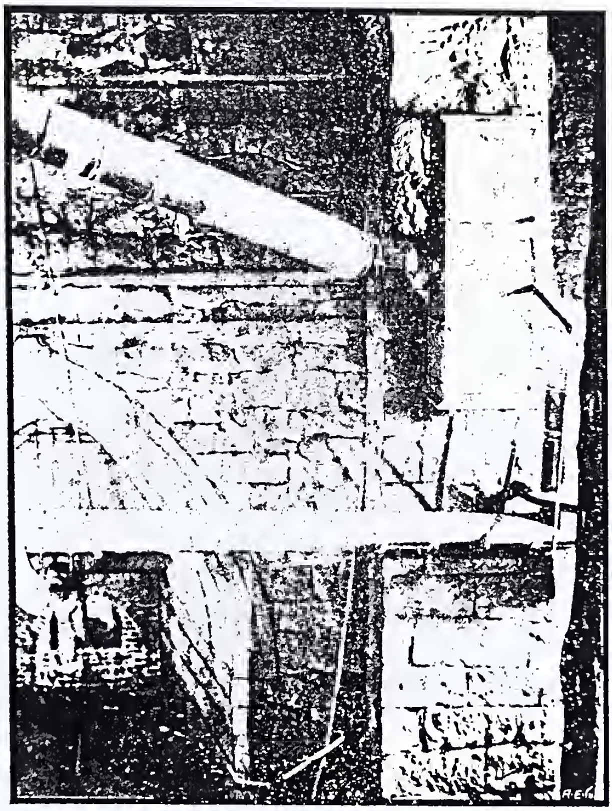
"Moulded goods, or castings of kettles, stoves, etc., are sold at the furnace for £5., 6s., 8d., per ton; in Philadelphia for £7, 6s., 8d., per ton."

As previously stated, Peter Grubb built the Hopewell Forges on the Hammer creek, one of which is said to have had a finery or run out fire, where the pig metal was converted into blooms, and the other a chafery forge, where the blooms were reheated and hammered out into bar iron.

Speedwell Forge was also located on the Hammer creek, a short distance below the Lower Hopewell Forge, and was built about 1760, by James Old, on land purchased by him from David Caldwell who had purchased it from Jacob Huber, the Warrantee, who also first owned and built Elizabeth Furnace. This was a chafery or bar iron forge and with the Hopewell Forges passed into the hands of Robert Coleman, about the year 1790. The three forges were kept in operation for a number of years when they were abandoned and dismantled, the last in operation being Speedwell Forge which was abandoned about the year 1865. The property attached to the forge is now a portion of the Cornwall estate.

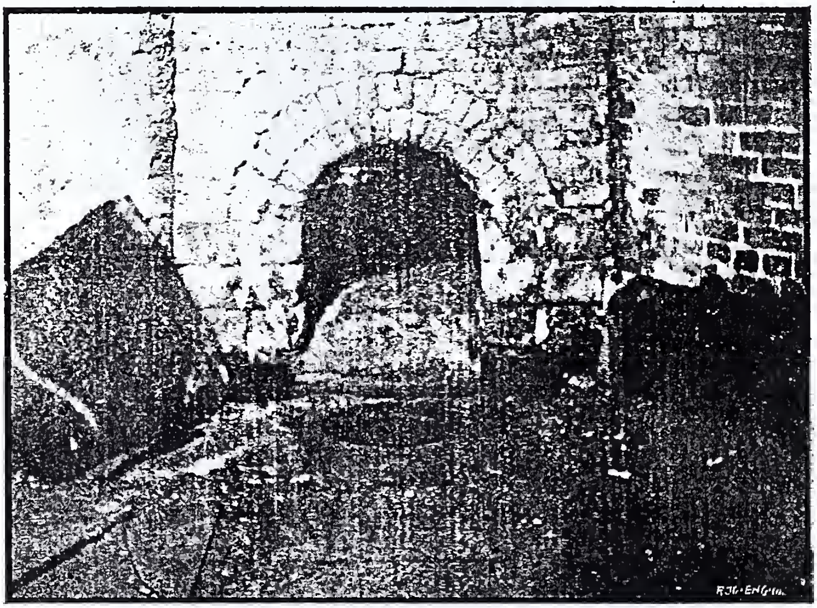
The second Cornwall Furnace was built on the site occupied by the present Charcoal Furnace, which was rebuilt in 1856, the power to run the blowing apparatus by means of a water-wheel being furnished by Furnace creek up to the year 1841, after which time the water wheel was supplanted by a steam engine. Swank speaking of the characteristics of the early furnace plants, says:

"Cornwall and Warwick furnaces were each 32 feet high, 21½ feet square at the base and 11 feet square at the top. All the works were operated by water power; at first large leather bellows were used exclusively to blow both the forges and the furnaces, but afterwards about the time of the Revolution, wooden cylinders or tubs were used. It was not until the beginning of the present century that steam power was experimently used to produce blast at either furnaces or forges in Pennsylvania, or in any other State. In 1840 steam power for



BACK TUYERE ARCH OF CORNWALL FURNACE, SHOWING TIN BLAST PIPE CONSTRUCTION AND WOODEN BLAST-GATE BOX.

driving the blast was successfully introduced at Conewingo Furnace, the boilers being placed at the tunnel head, and soon after it was successfully applied to Cornwall Furnace by the manager, Sam'l M. Reynolds. Warwick and Cornwall Furnaces, two of the best furnaces of the last century, retained their long bellows until the present century. Reading Furnaces, the neighbor of Warwick and also a rival of Warwick and Cornwall, was blown with leather bellows.



TOP OR TUNNEL-HEAD OF CORNWALL FURNACE, SHOWING ARCH THROUGH WHICH FURNACE GAS WAS DEFLECTED TO BOILERS.

"The Cornwall bellows was 20 feet 7 in. long, 5 feet 10 in. wide across the breech, and 14 in. wide at the insertion of the nozzle. Only one tuyere was used. The fuel used was exclusively charcoal, and the blast was always cold."

Schoepf says, "that about 400 bushels of charcoal were required to produce from the ore a ton of hammerred bar iron." He also says that mahogany was used to make the moulds for the castings of the furnaces, "because it warps and cracks the least."

During the Revolutionary war, under the ownership of Messrs Curtis and Peter Grubb, who were both colonels in the Continental army, cannon, shot, shell and stoves were cast at Cornwall Furnace for the Continental army. (One of the cannon that was condemned as defective and a quantity of solid shot are now kept as relics in the Mansion grounds, opposite the furnace.) Dr. Egle in the History of Lebanon county quotes a letter to Col. Peter Grubb, relative to the cannon cast at Cornwall. It was dated at Philadelphia, 18th September, 1776, and was signed by R. T. Paine, and reads as follows:

"Sir,—By Capt. Joy I understand you have at last made some 12-Pounders, but I fear they are heavier than they ought to be. Those made by Col. Bird weigh but 27 c and some under.

You have drawn on the Committee for £1500, it is not sent because the matter is not understood. We can't suppose you want such a sum to carry on the Works, & you certainly don't desire the Cannon to be paid for before they are delivered.

The sum you draw for is the value of the Guns already made, & as the contract was made with your Brother, Col. Curtis Grubb (Tho' you may be equally interested with him), yet I should like to hear from him before so large a sum was paid: however, I have sent you by Capt. Dan'l Joy one thousand dollars. I mentioned to Congress your inclination to have some of the prisoners from Lancaster to work for you, but it was supposed the Committee of Lancaster would object to it. I hope you will make all expedition in making the Cannon & getting them down, for they are much wanted.

The Cannon must be proved with two shott, or they will never be put on board the Ships. I am your hum'l Serv't."

In the Journal kept at Cornwall Furnace at that time, the first entry relative to Cannon cast there, was made Oct. 26, 1776, when John Smith was credited with hauling one Cannon to Philadelphia, for which he received £5. On Oct. 28, Geo. Zinn is credited with hauling one ; and on Nov. 2, Christian Gingry is also credited with hauling one to Philadelphia, for which service they each received £5. In March, April and June, 1777, the Furnace teams are credited with hauling four more, which embraces all the entries made in that book.

However by the Pig Iron book, under date of Aug. 14, 1777, it is recorded that 10 tons additional were hauled by Capt. Elton, wagon-master, and in October following, the same number of tons were hauled by Capt. Davis, all to be delivered to Charles Lukens at Philadelphia. In the Journal above referred to, on the 7th of July, 1777, there was credited to 22 Hessian Prisoners, 6 mo. 24½ days at 8/ per week, and 4 Prisoners at 45/ per month.

Under date of December, 1777, The Continental Congress is charged with "1 ton small ten-plate stoves sent to Sheffers Town pr order of Dr. Shippen, £125." In February, 1782, The United States are charged with a quantity of 8 & 10 inch shells and 12 & 18 pound shot that were made at Cornwall Furnace.

The following abstracts from the Furnace Books, while not properly belonging to the subject of this sketch, may nevertheless prove interesting: In July, 1776, the wages paid for harvesting, was 2/, 6d. per day. Boarding furnished employees is called "diet." The price of ten-plate stove castings was £18 per ton, and bar iron was sold at £26 per ton. The names of Dr. Oldenbruch, Dr. Edward Hand, Philip Marstellar and John Philip DeHaas who were prominent residents of Lebanon Township at that time, also appear in the books, in numerous entries. As Negro slavery was legalized by Wm. Penn and the Colonial Government, quite a number of slaves were owned by the Messrs. Grubb prior to and during the Revolutionary War, and at the time of the abolition of slavery in Pennsylvania, in 1780, they owned about two dozen slaves of both sexes. Some were house servants and others were furnace men, laborers, wood-choppers and colliers, and to a number were given the classical names of "Cæsar, Scipio, Pompey, Cato, Phoebe, Diana, etc. One of the colliers was called "Governor Dick," and tradition has it that he lived in a cabin at the foot of the high hill east of what is now known as "Mt. Gretna," and the hill was referred to as "Gov. Dick's Hill," by which name it was known for a long time, but it is now simplified to "Governor Dick."

ROBERT COLEMAN.

Mr. Robert Coleman first became connected with Cornwall Furnace in 1786, having purchased a sixth interest from Peter Grubb, Jr., a son of Col. Curtis Grubb. He subsequently purchased four additional sixths, and finally became the full owner in 1803.

He was born near Castlefinn, County Donegal, Ireland, on the 4th day of November, 1748, and emigrated to America in 1764, when 16 years of age; arriving at Philadelphia with letters of introduction to Blair McLanahan and Messrs. Biddle, he was recommended by them to Mr. Read, Prothonotary, Reading, Pa., in whose employ, as clerk, he remained nearly two years.

He then left Reading, and obtaining a subordinate position at the Hopewell Forges, in Lancaster County, then owned by Messrs. Curtis and Peter Grubb, was soon promoted to a clerkship. He remained here about six months, when he left to accept a situation at Quittapahilla Forge, (afterward known as New Market Forge), about 8 miles west of Lebanon, then operated under a lease by Mr. James Old, who was also the owner of Speedwell Forge, located on the Hammer creek, a short distance below the Hopewell Forges.

Some time after this, Mr. Old moved from Speedwell Forge to Reading Furnace, on French creek, and took Mr. Coleman with him. (This was the plant referred to in that part of this paper relating to the early iron industries of Pennsylvania, as having been built by Samuel Nutt in 1720,—a second and larger furnace having been built in 1736).

While at this furnace, Mr. Coleman was married to Ann Old, a daughter of his employer, on Monday, October 4th, 1773, Rev. Thomas Barton officiating. Fourteen children were born of this union.

Soon after this, Mr. Coleman rented Salford Forge, near Norristown, for a term of three years.

While here, he manufactured chain-bars that were intended to be used to span the Delaware river, for the defense of Philadelphia, against the approach of the English fleet.

Mr. Swank in "Iron Making in Pennsylvania," says, "His grandson, G. Dawson Coleman, has in his possession a document of rare interest, illustrative of Revolutionary experiences at Salford Forge. It is endorsed: 'Robert Coleman's memorial, presented August 26th, 1776, asking permission for his clerk and three forgemen to be exempted from marching with the army to Amboy.' It represented that the memorialist was an officer in Colonel Pott's battalion, and was then on his march to Amboy; that he had rented a forge for three years at a rental of 'two hundred a year,' the lease of which would expire in three months; that the 'principal part' of his workmen were Associators, who, if obliged to march with the militia, would cause him great loss and entirely prevent him from working up his stock in hand. The request of Mr. Coleman was granted the same day by the Council of Safety, to whom it was addressed."

After the expiration of the lease of Salford Forge, Mr. Coleman rented Elizabeth Furnace, in Lancaster County, and moved there in 1776.

He has left an interesting history of the "Elizabeth Furnace" estate, written by himself, which is now in the possession of the estate of G. Dawson, Coleman, dec'd, at Lebanon Furnaces, from which the following abstract has been taken, viz: "Some time previous to the year 1755, Jacob Huber, who then owned the tract of land upon which these works now stand, erected a small furnace there.

"Like all other new undertakings of this kind, commenced and conducted with but small experience of the business, Huber soon found it expedient to dispose of his establishment. Accordingly he parted with all his estate in the furnace tract, and such other lands as he had acquired, to a company composed of Henry William Stiegel, Charles Stedman and Alexander Stedman. The Stedmans living at a distance, Stiegel became the active owner and manager of the estate. He accordingly took possession in the year 1757, erected a new furnace, and carried on the work for a space of about eighteen years, during which period he acquired for the use of the company a considerable addition to the furnace lands, and also made some purchases in his own right. In the meantime Mr. Stiegel became embarrassed in his circumstances. He fell largely in debt to Daniel Bennezet, of Philadelphia, for the security of which debt he mortgaged all his undivided part of the Elizabeth Furnace estate to Mr. Bennezet, and not having paid the money, proceedings were had upon the mortgage, a levari facias issued upon a judgment obtained thereupon, by virtue of which a sale was made by John Ferree, Esq., high sheriff of Lancaster county, to Daniel Bennezet, the mortgagee, who received a deed for the mortgaged premises dated the 5th of May, 1775. Daniel Bennezet also became the purchaser, at two other and subsequent sheriff's sales, of other lands belonging to Mr. Stiegel.

"In the year 1776, possessed of but a small capital, and recently married, I took a lease for the Elizabeth Furnace estate for the term of seven years, not anticipating at that time that before the expiration of the lease I should have it in my power to become owner in fee simple of the whole or a greater part of the estate. Success, however, crowned my endeavors. A new and regular system was adopted, by which the business of the iron works was made to resemble more a well conducted manufactory than the scenes of confusion and disorder which had before that time prevailed in that business. During the continuance of the lease I made several purchases of lands contiguous to the estate, and in the year 1780 I purchased from John

PROPERTY OF THE
LEBANON COUNTY
HISTORICAL SOCIETY
LEBANON, PA.

Dickinson, Esq., the one undivided third part of the Elizabeth Furnace and lands thereunto belonging,—he having before that time become the owner of all the estate and interest which Alexander Stedman held in the same. In the year 1784 I purchased out Mr. Charles Stedman, who also held an undivided third part of the estate. The remaining third part of the original estate was not purchased by me from Daniel Bennezet until the year 1794, he either not being inclined to sell, or asking more than I thought it expedient to give."

Swank, in his "History of Iron Making in Pennsylvania," says, "On the furnace erected by Huber, whose first name was probably Jacob, and not John, the following legend was inscribed :

" Johan Huber, der erste Deutsche man
Der das Eisenwerk vollfueren kann."

As Jacob Huber not only took up the land on which Elizabeth Furnace was erected, but also the land on which Speedwell Forge was erected, he must have been a prominent landowner in that locality about 1750, and there is reason to believe the legend is incorrect in ascribing the glory to John, instead of Jacob, as Mr. Coleman also credits Jacob with the ownership of Elizabeth Furnace, but no mention is made of John, although it is possible his name was John Jacob.

Mr. Swank further says, "After Elizabeth Furnace came into possession of Robert Coleman, he made shot and shell for the Continental army, and some of the transactions which occurred between him and the Government in settlement of his accounts for these supplies are very interesting. Under date of October 26, 1780, the following entry is made by Mr. Coleman to the credit of the United States : 'By cash received of William Thorne, Paymaster, 107,319,15-90 dolls., old emission, exchange 73 for one, £551,5,11.' In August, 1781, another credit is entered of '328 dolls., new emission, three for one,' which shows an appreciation in the value of the currency. Two months later, exchange was at two and a half for one.

"On November 16, 1782, appears the following entry : 'By cash, being the value of 42 German prisoners of war, at £30 each, £1260;' and on June 14, 1783, the following: 'By cash, being the value of 28 German prisoners of war, at £30 each, £840.' In a foot note to these credits, Robert Coleman certifies 'on honour' that the above 70 prisoners were all ever secured by him, one of whom, being returned, is to be deducted when he produces the proper voucher. Rupp in his history of Lancaster county mentions that in 1843 he visited one of the Hessian mercenaries who was thus disposed of at the close of the war for the sum of £30, for the term of three years, to Captain Jacob Zimmerman of said county."

Elizabeth Furnace remained in possession of Robert Coleman until his death in 1825, when it passed to James Coleman, his second son; and after his death it passed to his son, George Dawson Coleman, and now belongs to his estate. The furnace was in almost continuous operation until 1856, when it was abandoned and dismantled.

It was here that Messrs. Charles B. Forney and Nathaniel Ferguson took their first lessons in the manufacture of iron.

Mr. J. Taylor Boyd had also been employed here, before coming to Cornwall, in 1853.

Robert Coleman first acquired an interest in Cornwall Furnace, (now known as the Cornwall estate), and the Hopewell Forges, by a deed from Peter Grubb (Curtis' son) and Mary his wife, dated May 9th, 1736, conveying the undivided one-sixth part, and by two other successive purchases, he acquired four additional sixths, and finally by proceedings in partition, the entire property was allotted to him on the 18th day of February, 1803.

In 1791, Mr. Coleman built Colebrook furnace on the Conewago creek, about five miles southwest from Cornwall.

Robert Coleman was evidently a man of great force of character and executive ability, and was practically "the founder of his own fortune."

He was prominent not only as an iron-master, but as a citizen as well.

He was an officer in the Pennsylvania militia during the Revolutionary war, a member of the State Convention which framed the Constitution of 1790, and a member of the Legislature. He raised and commanded a troop of cavalry during the "Whiskey Insurrection," was a Presidential elector-at-large in 1792, and a Presidential elector for his Congressional district in 1796, and an Associate Judge of Lancaster County, for nearly twenty years.

He died at Lancaster, on the 14th day of August, 1825, and is buried in St. James Episcopal church-yard, in that city.

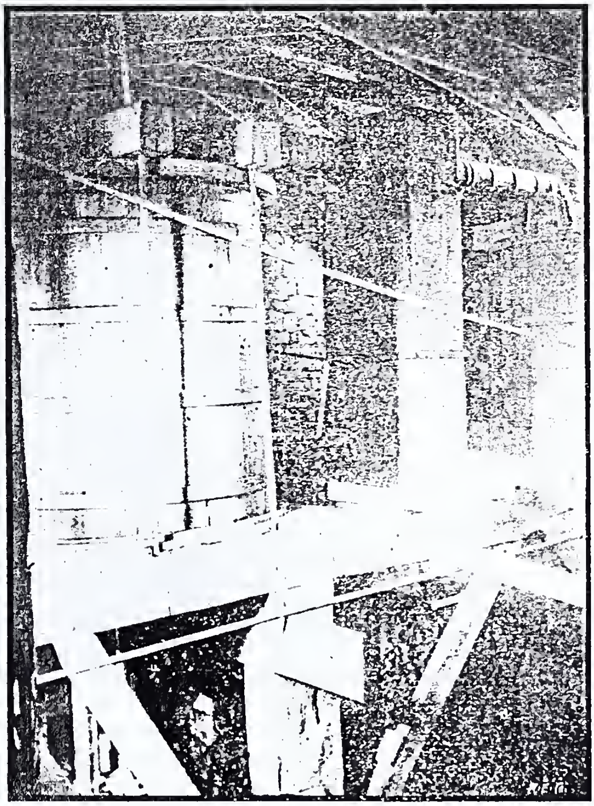
SUBSEQUENT OWNERS OF CORNWALL FURNACE.

After the death of Robert Coleman Cornwall Furnace passed to his three eldest sons, William, James and Edward Coleman, who afterward sold it to Thomas Bird Coleman, the fourth son of Robert Coleman, who remained the owner of the property up to the time of his death, on September 10th, 1836, when it passed to his son, Robert W. Coleman.

Mr. Thomas Bird Coleman, who was born at Elizabeth Furnace on the 4th day of September, 1794, was quite a prominent iron-master in his day, owning in addition to Cornwall Furnace, the furnace, at Colebrook, Lebanon County; Castlefin Forge, in York County, where he also erected a steel furnace, in 1832, and the Hopewell and Speedwell Forges, in Lancaster County.

Mr. Robert W. Coleman, who succeeded his father, continued operating Cornwall Furnace up to the time of his death, in December, 1864. His successors, who were known by the firm name of R. W. Coleman's Heirs," were his sisters, Anne C. Alden, Margaret C. Freeman and Sarah H. Coleman, and Robert H. and Anne C. Coleman, children of a deceased brother,—the latter two withdrawing from the firm in December, 1881.

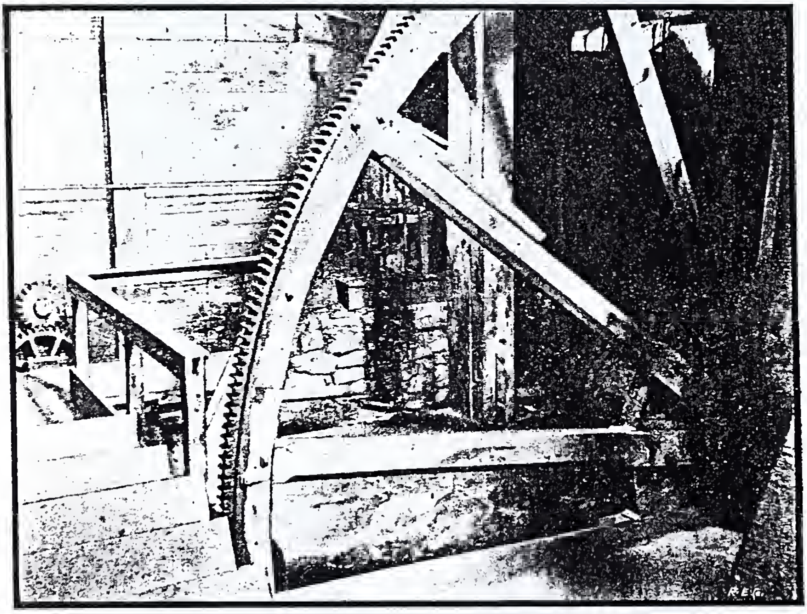
They continued the manufacture of cold-blast charcoal iron until February 11th, 1883, since that time the furnace has been standing idle. It is yet in good condition, but owing to the limited demand for cold-blast charcoal iron, on account of the expense incident to its manufacture, it is hardly probable that it will again be put in blast. The property is now owned by "The Cornwall Iron Company," and the furnace is said to be the oldest in the United States, that has been operated continuously on the site of the original furnace.



SIDE VIEW OF WOODEN BLOWING TUBS OR CYLINDERS AT CORNWALL FURNACE, 1901.

The Stack of Cornwall Furnace as now standing, is built of native sand-stone, and is 28 feet square at the base, 23 feet square at the top and 31 ft. 8 in. in height. The crucible is 3 ft. in diameter, the bosh 7 ft. and the opening at the top 17 in. in diameter. It has one tymp or fore-part arch and three tuyere arches. As cold-blast has only been used, all the connecting pipe are made of tin, and the blast valve at the rear of the furnace is made of wood.

The blast is furnished by an 8" x 24" horizontal steam engine of about 20 H. P., which is geared to a counter-shaft, which is in turn geared to a large wooden wheel of the blowing apparatus. The shaft of this wheel is also of wood, and to its ends are fastened iron cranks. The connecting rods attached to these cranks are made of wood.



LOWER PART OF BLOWING APPARATUS USED AT CORNWALL
FURNACE, SHOWING GEARED WOODEN WHEEL
AND SHAFT, 1901.

The two blowing tubs or cylinders are made of wooden staves, and are held together by means of heavy flat iron hoops or bands, and the cylinder heads, which are made of heavy plank extending over the staves, are held in place by means of four vertical bolts passing through two transverse timbers placed across each head. The inlet or receiving valves, of which there is one placed in each cylinder head, are made of wood faced with leather and are each attached to a pivoted counterweighted lever, and the discharge valves, of which there is also but one in each head, are made of the same material and are closed by means of springs.

The discharge blast pipe from the cylinders are connected to an upright square wooden box placed between them, and from it the blast is taken to the furnace by means of a tin pipe about 12 inches in diameter.

Steam was generated in two single cylinder boilers that are placed on top of the furnace, to one side of the tunnel head opening, from which the furnace gas was deflected to the boilers. While the plant appears to be very primitive as compared to a modern blast furnace, at the time of its erection it was considered to be one of the model furnaces of the country.

HENRY WILLIAM STIEGEL.

As reference is made by Mr. Robert Coleman in his history of the Elizabeth estate, to Henry William Stiegel as having been one of his predecessors in the ownership of Elizabeth Furnace, and as his name has been prominent among the pioneers in the iron industry of Pennsylvania, a short sketch of his life will be pertinent.

Henry William Stiegel, or Baron Stiegel as he was called, was born at Manheim, in Germany, and emigrated to this country from Rotterdam, on the ship "Nancy," arriving Aug. 31st, 1750. (His name appearing in the list of immigrants published in "Rupp's collection of 30,000 names.")

Although he was called "Baron," his claim to that title is said to doubtful, and the supposition is, it was assumed by him after his arrival in this country.

Dr. Joseph H. Dubbs, of Lancaster, Pa., is reported to have investigated Stiegel's claim to the honor, but was unable to find a record of it at Manheim, in Germany. He found, however, that about the time of Stiegel's departure, a young Baron named Stengel, who answered Stiegel's description, had left Manheim for America.

As stated by Mr. Coleman, the company was composed of Henry William Stiegel, Charles Stedman and Alexander Stedman, who purchased and took possession of what was afterward known as "Elizabeth Furnace," in the year 1757, and Stiegel became the active owner and manager of the estate.

They erected a new furnace and carried on the works for a period of about eighteen years.

Here, in addition to making pig iron and following the advancement made at other furnace plants, they also made stoves, kettles, salt-pans and other castings, nearly all of which were sold in the neighborhood.

The stoves are quite rare at present, and but few perfect ones can be found. Dr. Dubbs records the fact that Stiegel's stoves bore the inscription—

" Baron Stiegel ist der Mann
Der die ofen machen kann."

H. C. Mercer, Esq., of Doylestown, Penna., in his interesting paper on "The Decorated Stove Plates of the Pennsylvania Germans," refers to and illustrates a ten plate stove made at Elizabeth Furnace, in 1762, that is now owned by Mr. Geo. H. Danner, of Manheim, Penna. He also describes and illustrates a right side plate of a jamb or wall stove, that is decorated with a heart, tulips, and a scroll, and has the following inscription, "H. W.HELM STIEGEL UND COMPAGNI FOR ELIZABETH 1758.

The name "Elizabeth," applied to the furnace property, was in honor of Stiegel's wife, who had been Elizabeth Huber, a daughter of Jacob Huber, the original owner of the plant, to whom he was married on the 7th day of November, 1752.

Stiegel is also said to have owned Charming Forge, in Berks county, about the year 1763.

In 1762, he laid out the town of Manheim, in Lancaster county, and gave it its name after his place of birth.

Here he built a fine mansion of brick and other materials imported from Europe, which he is said to have finished and furnished very elaborately. A few years later, he established a glass factory at Manheim, which was called "The American Flint Glass Factory," which remained in operation up to 1774.

In addition to having a mansion at both Manheim and at Elizabeth Furnace, Baron Stiegel also erected a castle on what is called Tower Hill, a short distance south of Schaefferstown, Lebanon county;—and tradition says, his visits to any of his places of residence was announced by the firing of a cannon, to summon his friends and neighbors to join in celebrating his coming.

As his extravagant mode of living, and other causes, brought on financial embarrassment, he was arrested and imprisoned for debt, but was liberated by a special Act of Assembly, passed Dec. 24th, 1774.

His interest in Elizabeth Furnace was sold at Sheriff's sale to Daniel Bennezet, in the spring of 1775, and shortly afterward his remaining possessions were also sold by the Sheriff, leaving him practically penniless.

He eked out an existence after this, teaching school at Brickerville and Schaefferstown and clerking at Reading Furnace. He died during the summer of 1783, in Heidelberg township, Berks county, and is buried in the Lutheran graveyard, near Womelsdorf, Penna.

The Cornwall Ore Banks, or Mine-Hills.

It is not known when or by whom this immense and celebrated deposit of Magnetic Iron Ore was first discovered, or its value recognized. It is to be presumed, however, that it was Peter Grubb, who first developed and used the ore, as the two individual owners who preceded him in the ownership of the land, and who both sold their holdings for nominal amounts, evidently knew little or nothing of the ore deposits, or its extent and value; and this theory appears to be more reasonable as both Joseph Turner and William Allen,[*] the aforesaid owners, were iron-masters and members of the company that had built and were operating Durham Furnace in 1727, as referred to in the first part of this paper.

The land on which the Ore Banks are located was included in the original grant of the Charter or Letters Patent to Wm. Penn, by Charles II, King of England, etc., dated March 4, 1681, and called in the Charter, Pennsylvania.

Wm. Penn died in 1718, leaving the title to his chartered rights in Pennsylvania to his sons, John, Thomas and Richard Penn.

On the 8th day of May, 1732, John, Thomas and Richard Penn, for the sum of £500, money of Pennsylvania, (a pound Penna. currency being worth $2.66⅔ of our present money) granted a warrant for 5,000 acres of land in the Province of Pennsylvania to Joseph Turner, of the city of Philadelphia, who afterward assigned it to William Allen.

William Allen then by agreement dated April 5th, 1734, sold 300 of the 5,000 acres of the land called for in the Warrant, to Peter Grubb for the sum of £135,—which said land was surveyed April 8th, 1734. On the 28th and 29th days of November, 1737, William Allen by Deeds of Lease and Release, granted and conveyed the said tract of land containing 300 acres unto said Peter Grubb, his heirs and assigns in fee, who procured a Patent Deed for it from the Proprietaries on the 30th day of November, 1737. As this grant to Peter Grubb, however, did not entirely embrace the Ore Hills, he was granted a Warrant by the Proprietaries of Pennsylvania on the second day of December, 1737, on which was surveyed and returned in his name, two tracts of land contiguous to the 300 acre tract and containing together 142½ acres; thus making the whole tract, which was in the form of a rectangular parallellogram, (200 perches north and south, and 380 east and west), contain altogether, 442½ acres of land, as per said returns.

---

[*] William Allen was also largely interested in the manufacture of iron in New Jersey, and was Chief Justice of Pennsylvania from 1751 to 1774 and remained a staunch Royalist to the time of his death in 1780. The city of Allentown, Pa., was named after him.

Peter Grubb had also taken out a Warrant for a tract of land adjoining the above described tracts on the west and north, on the 2nd day of November, 1734, on which was returned 195 acres.

From the above, it is evident that 1734 was the year in which Peter Grubb first appeared on the scene, and as Cornwall in England was his ancestral home, that name was applied to his new possessions to perpetuate it.

As there was no opportunity to use the ore until the erection of the first blast furnace in 1742, except possibly in an experimental way,—no mining was necessary until that time, and it is doubtful if any openings for mining purposes were made for some years, as there must have been plenty of ore to be found lying loose on the surface.

Peter Grubb continued to be the sole owner of the Ore Banks up to the time of his death in 1754, when, dying intestate, all his property descended to his two sons, Curtis and Peter Grubb, Curtis, the elder son, taking two-thirds, and Peter, the younger son, one-third thereof.

On the 28th day of June, 1783, Curtis Grubb granted and conveyed inter alia, to Peter Grubb, his eldest son, and to his heirs and assigns forever, the full equal undivided one-sixth part of all his estate, including the Cornwall Ore Banks or Mine-Hills.

On the 26th day of September, 1785, Peter Grubb (Curtis' son) entered into articles of agreement with Robert Coleman to sell and convey to him, all his right, title and interest of, in and to the said undivided one-sixth part of the estate above referred to.

On the 9th day of May, 1786, the said Peter Grubb and Mary, his wife, granted and conveyed the aforesaid undivided one-sixth part to Robert Coleman, his heirs and assigns forever, reserving and excepting thereout for himself, his heirs and assigns forever, the right "of digging, raising and hauling away a sufficient quantity of iron ore for the supply of any one furnace, at the election of the said Peter Grubb, his heirs and assigns, at all times hereafter." This right was afterward sold by Peter Grubb, Jr., to Geo. Ege, through whom it became vested in what is now known as the "Robesonia Iron Co."

By an agreement dated Dec. 8th, 1785, amicable actions were entered into in the Court of Common Pleas of Lancaster County, between Curtis Grubb, Robert Coleman and Peter Grubb, for the partition of the said Ore Banks or Mine-Hills. However, before any final settlement or adjudication could be made under said proceedings, Peter Grubb died, leaving two sons, Burd Grubb and Henry Bates Grubb, surviving him, to whom, by Will dated May 7, 1784, all his estate was devised, including the one-third interest in the Ore Banks or Mine-Hills, to be equally held by them as tenants in common.

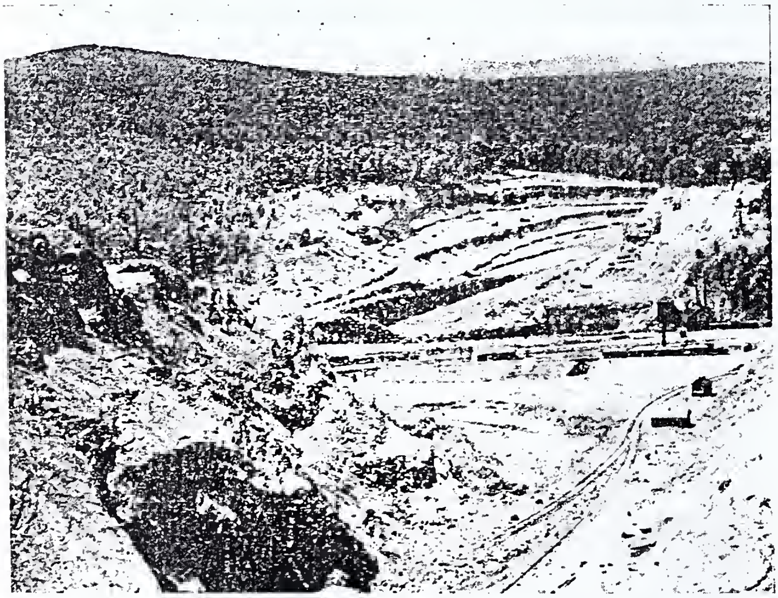
On the 6th day of May, 1786, an agreement was entered into between Curtis Grubb and Robert Coleman, and Jasper Yeates, Edward Burd, James Clemson, Joseph Shippen and Edward Hand, the last five named having been the Executors, &c., of said Peter Grubb, dec'd, as well as guardians of his sons, Burd and Henry Bates Grubb, in which it was agreed that the said Ore Banks or Mine-Hills should be divided into three equal parts,—two equal third parts to be assigned and allotted to Curtis Grubb and Robert Coleman, according to their several shares therein, and one equal third part to be assigned and allotted to Burd Grubb and Henry Bates Grubb, as tenants in common.

While these proceedings in partition were yet pending, apparently the difficulties encountered in trying to make an equitable division of the Ore Banks became insurmountable, as another agreement was entered into on the 30th day of August, 1787, between the said parties in which the agreement of May 6, 1786, as far as it related to the said Ore Banks, was changed, to the extent that the said Ore Banks and Mine-Hills should thereafter remain together and undivided, as a tenancy in common; Curtis Grubb being entitled to three-sixths parts thereof; Robert Coleman being entitled to one-sixth part thereof, and the said minor children (Burd Grubb and Henry Bates Grubb) being entitled to the remaining two-sixths parts thereof. It also directed that an accurate survey and map of said Ore Banks or Hills should be made; which survey and map were afterward made by Thos. Clark, and has ever since been referred to and known as "The Clark Survey." On this map the three Ore Hills are designated as "The Large Iron Hill," "The Middle Hill," and "The Grassy Hill."

Curtis Grubb died, leaving a Will dated the 18th day of March, 1788. Under its provisions to sell, his executors sold all the real estate of said Curtis Grubb, including the three-sixths of the Ore Banks to Robert Coleman and by Indenture dated Jan. 12, 1798, for the consideration of £29,100 granted and conveyed it to said Robert Coleman, in fee, subject to agreement of May 6, 1786, and Aug. 30, 1787, relative to holding the Ore Banks as a tenancy in common.

On the 4th day of May, 1798, Burd Grubb granted and conveyed to Henry Bates Grubb, in fee, all his right, title and interest to all the estate devised to him by his father, Peter Grubb, including his interest in the Ore Banks and Mine-Hills, and on the 12th day of May, 1798, the said Henry Bates Grubb granted and conveyed to Robert Coleman, in fee, an equal and undivided moiety or one-half of all his real estate including the Ore Banks (the interest conveyed, being that which was purchased from Burd Grubb.) By these last purchases Robert Coleman became the owner of five-sixths of the Ore Banks,—the remaining one-sixth being held by Henry Bates Grubb.

Robert Coleman died at Lancaster, Pa., in 1825, and by his last will and testament, bearing date the 8th day of March, 1822, devised, inter alia, his interest in said Ore Bank and Mine-Hills to his four sons, William, James, Edward and Thomas Bard Coleman, as tenants in common.



VIEW OF CORNWALL ORE BANKS FROM TOP OF BIG HILL LOOKING SOUTH-WEST ACROSS MIDDLE HILL.

For the purpose of making a proper sub-division of the holdings of the individual owners, the entire interest was considered as if divided into 96 equal parts, thereby allotting 20-96ths to each of the four sons of Robert Coleman, and 16-96ths to Henry Bates Grubb.

On the 23rd day of April, 1828, William Coleman conveyed his 20-96ths to Thomas Burd Coleman, and Edward Coleman conveyed his 20-96ths to James Coleman and Thomas Burd Coleman, as tenants in common.

By these conveyances, in addition to their former holdings, James Coleman became the owner of 30-96ths, and Thomas Burd Coleman the owner of 50-96ths;—16-96ths, as before stated, being owned by Henry Bates Grubb.

James Coleman's interest subsequently passed to his two sons, Robert Coleman and George Dawson Coleman, each receiving 15-96ths. These interests are now held respectively by Rosalie Parant Coleman, widow of Robert Coleman, who resides in Paris, France, and by the estate of G. Dawson Coleman.

Thomas Burd Coleman's interest has also been sub-divided, 15⅝-96ths being held by Annie C. Rogers; 15⅝-96ths by The Lackawanna Iron and Steel Co.; 12½-96ths by the Freeman family of Cornwall, and 6¼-96ths by the Alden family of New York. The Grubb interest, (excepting 1-96th part which is owned by The Penna. Furnace Co.), being sub-divided among members of the Grubb family.[*]

As before stated, the Ore Banks are composed of three hills, called the Large Iron Hill or Big Hill, Middle Hill and Grassy Hill. The area of the Big Hill, according to the Clark Survey, is 58 acres, 7 perches; that of the Middle Hill, which contains the principal body of ore, is 35 acres, 116 perches, and that of the Grassy Hill 10 acres, 49 perches,—the Weidle location of the Clark Survey, made in July, 1844, makes the total quantity about 4 acres more.

While the ore deposit forms a continuous body, from the top of Big Hill to the west side of Grassy Hill, a distance of about

---

[*] NOTE.—Since the foregoing was written, the 15-96ths held by the estate of G. Dawson Coleman, dec'd, the 15⅝-96ths held by Annie C. Rogers and 10-96ths held by part of the Grubb family, a total of 40⅝-96ths part of the Cornwall Banks has been purchased by the Penna. Steel Company.

4,600 feet, it covers only about 1-5 of the area of Big Hill and about two-thirds the area of the two other hills.

It extends southwardly, however, beyond the southern lines of the Clark Survey, under the red sandstone formation, but how far, has not yet been determined.

The original height of the Big Hill above the level of Furnace creek which flows between it and Middle Hill, was 326 feet; that of Middle was 148 feet, and that of Grassy Hill was 123 feet.

The ore deposit on Big Hill was about 1,400 feet in length and averaged about 400 feet in width at the top. The foot walls of trap rock, however, converged so rapidly that it did not extend to any great depth, and now since the ore has been nearly all removed, it has left a V shaped trough sloping downward, in a south-westerly direction.

The deposits on the Middle and Grassy Hills, while showing that a great portion has been removed, are still quite large and it will take some years until the foot wall is reached at the south-west corner of Middle Hill, where a test hole shows a depth of 300 feet of ore below the level of Furnace creek.

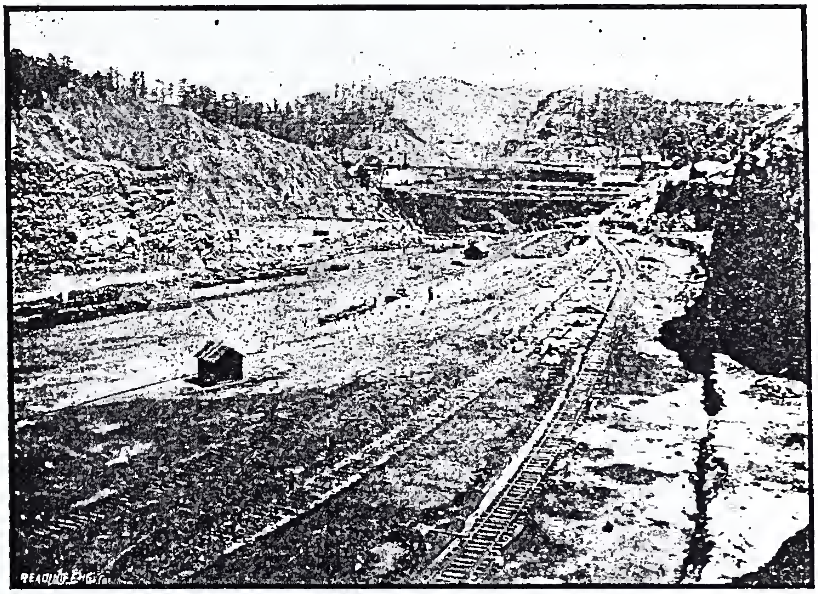
The early mining operations were very primitive, and up to the time of the construction of the North Lebanon, now Cornwall Railroad, in 1856, all the ore removed was hauled by wagons, direct to the furnaces in the neighborhood, and even as far as Mt. Vernon Furnace, at Conewago; Manada Furnace, in Dauphin county, and Reading Furnace, at Robesonia.

A quantity of ore was also shipped by boats on the Union canal to points east and west, the ore being hauled by wagons and delivered to different landings along the canal at Lebanon. As the heavy hauling at all seasons of the year, kept the only road between Cornwall and Lebanon, (which ran by way of Zinn's Mill), in an almost impassible condition, the Lebanon and Mt. Hope Plank Road was built in 1852, and greatly facilitated the hauling and delivery of the ore to the canal and to the Lebanon Furnaces.

No doubt some of our older citizens may remember the noise and bustle the passing of these ore teams gave to the quiet streets of Lebanon, as many of the horses were decorated with ribbons and yokes with jingling bells.

After the year 1858, nearly all the ore mined was shipped by rail, and as the demand became greater each year, new and improved methods of mining were adopted from time to time.

Prior to the formation of the Cornwall Ore Bank Company, each individual owner mined and removed ore from such places as best suited his purpose, or was most convenient for him, all preferably taking the surface ore which was oxydized and desulphurized by exposure to the elements, but strange to say, some of the heaviest and best ore that was known by the name of "Nigger Head Ore," was rejected as being too rich, and quantities were used to fill up holes that the wagons made in the roadway.



VIEW OF CORNWALL ORE BANKS FROM WEST SIDE OF MIDDLE HILL, LOOKING NORTH-EAST TO BIG HILL.

Considerable copper ore, in the form of pyrites, carbonates and red oxide, was mined in the upper strata of the Mine-Hills, particularly on Middle Hill, and forty years ago its surface was honey-combed with shafts and drifts that were dug for the purpose of removing it, and hundreds of tons were sent to the smelters at Phoenixville, Pa., and Baltimore, Md.

Since the removal of the upper strata, very little copper can be found except in the form of pyrites, and that not in sufficient quantity to pay for its selection and separation. Occasionally, beautiful specimens of native metallic copper, with a fern-like appearance, have been found in fissures and crevices in the upper strata, but are now rarely met with. After the formation of the Cornwall Ore Bank Company in February, 1864, still further improvements in mining were introduced. A spiral railroad with laterals was projected by Wm. Lorenz, C. E., and built to the top of the Big Hill, and other laterals were run into Middle and Grassy Hills, by which means the ore was loaded direct on cars as mined, instead of first loading it on wagons and hauling it to the ore landings along the Cornwall Railroad and then loading it on cars, as had formerly been done.

The spiral railroad above referred to, which was abandoned a few years ago, on account of the ore deposit on Big Hill being practically exhausted, was at the time of its construction considered to be a great engineering feat and was inspected by numbers of eminent American and foreign civil engineers.

Rock drills, at first run by steam and afterward by compressed air, were added to the mining equipment, which with new and powerful blasting compounds have greatly changed the appearance of the ore hills in the past few years. The system of mining in terraces, with railroad tracks arranged as switchbacks from higher to lower levels, has been adopted, and quite recently a new and larger air compressor plant to furnish the power to run the rock drills has been erected east of the Middle Hill.

With the future deepening and extending of the mines, particularly under the tracks of the Cornwall Railroad, new engineering problems will no doubt be encountered, and in all probability either vertical lifts or inclined planes will have to be adopted to raise the ore to the surface tracks.

The Robesonia Iron Company, who are mining under the ore-right reserved by Peter Grubb, before referred to, have deepened their working along the west side of the old Horse Shoe pike to nearly 100 feet below the surface, and raise and load on cars at the surface all the ore mined by them, by means of an inclined plane and tipple.

THE FOLLOWING ARE SOME OF THE THEORIES RELATIVE TO THE FORMATION OF THE CORNWALL ORE BANKS, FROM A GEOLOGICAL STANDPOINT.

In the History of Lebanon County, Dr. Egle gives the views of a number of Scientists relative to the deposit, and says: "According to the theories of Professors Rogers and Booth, the great Cornwall iron ore deposit, by far the most extensive and one of the most interesting in the State, is situated at the outcrop of the primal slates, where they arise from beneath the auroral limestone in Lebanon county, on the south-east border of the Kittochtinny Valley. The ore strata are embraced in three hills, having a nearly east and west range. These hills are flanked to the north by the auroral limestone, and south by the overlapping, unconformable Mesozoic red sandstone. The eastern or "Big" hill is elevated three hundred and twelve feet above the level of the creek at the base. The Middle hill is ninety-eight feet high. The bounding wall of the ore in the Big hill is a heavy dike of trap, which varies in regard to texture and composition as the feldspar or hornbiendic element predominates. Besides this general outer wall of trap there are several smaller dikes of the same material, in one or two instances interstratified with ore; in other cases they appear as simple isolated columns of rock surrounded by ore. The ore in this hill is nearly horizontally, though irregularly stratified, and presents every possible aspect from slaty greenish grey to dark green, and dark ferrugious brown and black. In the Middle hill masses of light-blue, flinty and magnesian-limestone are found imbedded with and surrounded by ore. They are devoid of regular form, and evidently not 'in situ.' On this hill several small veins or bunches of copper have been wrought. The thickness of these veins varies between half an inch and three inches. The usual varieties of copper ore extracted are gray protoxide, bright varieties of red derioxide, green and blue carbonates of copper, and also rich specimens of sulphuret.

"The iron ore in Cornwall is the upper primal slate itself, or its highest beds, rather, in a very ferruginous condition. The trap-dikes convert the ore to a more highly crystalline form, and endow it partially with magnetism. These mines were formed by igneous and volcanic action, causing the separation of the iron from the primal slates, and the aggregation of the immense masses of rich ore. The process has been illustrated to be somewhat similar to that of a furnace operation, in which the iron, trap-rocks and primal slates were all in a state of fusion, and were by some operation placed in the positions in which they are now found, the ridge of altered primal slates to the north of the mine-hills representing the cinder-bank of this gigantic furnace operation in nature.

"Other geologists and scientists contend that the Cornwall mines are within and at the borders of the Triassic—Mesozoic red sandstone—formation, and that there are good reasons for believing that they properly belong to it, not to the primal slates or the Azoic. They argue that the geological structure and mineral associations of these ore deposits are in many respects different from the primal slates, and from the magnetic and crystalline ores of the Huronian and Laurentian formations.

"The range and dip of these deposits and the accompanying strata, generally differ from that of the primal slates and older rocks; and the trap-dikes almost universally associated with these ores, are almost in many respects unlike those of the older formation. On the other hand, they seem to very generally correspond with the Triassic formation, except where they have been distributed and changed by trap-dikes, and there is scarcely any noticeable difference between the dikes associated with these ores and others in the Triassic. This similarity in range and dip and in the trap-dikes, indicates, according to this second theory, close relation, if not actual sameness, in formation. It is also a well known fact that in no other formation do these trap-dikes constitute so prominent a feature as in the Triassic, and there would seem to be reasonable grounds for placing all these similar dikes with their associate ores in the same geological horizon, especially as they are at and within the borders of the same formation.

"The apparent similarity between these ores and the accompanying rocks and some of the ores and rocks of older formations seems to be the only reason for fixing their position outside of the Triassic. But this similarity can be easily explained by the generally accepted theory of the formation of the Triassic and its trap-dikes. The theory is that the older rocks with their ores, either in a wholly or partially decomposed and disintegrated condition were washed away (frequently by strong currents) into the Mesozoric estuary, and there redistributed and deposited without much change in the character of the material, especially near the borders, so that in many places this material is easily recognized as having been derived from older formations. That subsequent to the deposition of the Triassic strata, igneous action produced uplifts and outbursts, which formed the hills and trap-dikes so common in this formation, and changed and metamorphosed the redistributed material. If this theory is correct it can readily be seen that if the primal slates and the Huronian Laurentian rocks and their ores were redistributed by strong currents of water (and perhaps down great declivities) that the heavier material and the larger particles would be deposited near their former position and with the least change in their composing elements, and that the lighter and more thoroughly disintegrated particles would be carried farther from the borders and precipitated in a more changed condition. It is also evident that if this redistributed material (including the ores) unaltered in its constituent parts, was subjected to the proper heat it would again assume almost, if not precisely, the same characteristics and appearance as it had in its former crystalline condition. The few reasons here advanced for fixing the geological position of the Cornwall iron-mines and other related ores in Triassic or Mesozoic red sandstone may not be conclusive, but they furnish the basis for a reasonable and consistent explanation of the phenomena and geological peculiarities exhibited in these interesting and important deposits of ore and the accompanying rocks."

Prof. J. P. Lesley, State Geologist, in the Summary Final Report on the Geology of Pennsylvania, published in 1892, says:

"This summary description of the Lower Silurian Formation No. II would be incomplete without special mention of one of the most important mines in Pennsylvania, the great magnetic iron ore mine of Cornwall, in Lebanon County, unique in its character, standing alone in the geology of the State, and pouring year after year its flood of wealth into the business world. Worked for more than fifty years it shows no sign of exhaustion; on the contrary, its annual output continually swells in volume.

"Three hills of ore, three hundred feet high, are ranged in a line a mile long and a third of a mile wide. Walls of solid ore 80 feet in vertical height are stoped down by dynamite, and the fragments broken up to portable sizes are loaded in cars and distributed to the iron furnaces of the region. A floor of the solid iron ore at water level conceals an underlying ore mass, into which test holes have been bored varying in depth from 50 to 300 feet. A great volcanic trap-dike, like the half of a cup, supports the ore mass at its northern edge, and has been proved by some of the bore holes to be its floor. Along the southern edge runs one of the few great faults of the State limiting the ore mass on that side. Against this fault descends (northward) at a gentle slope the Mesozoic beds of northern Lancaster, their sheared off edges making the southern side of the cup which holds the ore mass.

"It is this unusual occurrence of Mesozoic red sandstone faulted against the limestone formation of the Great Valley with an outburst of ancient lava rising through the crack thus produced and making its way sidewise between the limestone strata, lifting them and holding them isolated, as in a vat in a chemical laboratory,—it is this unusual combination of circumstances which has given its unique character to the Cornwall iron-mine. The mine has been a puzzle to geologists; and a satisfactory explanation of it has only been recently obtained by a laborious research upon the ground.

"It is now made evident that the whole ore mass was originally a set of lime-shale strata belonging to the very top of Formation No. II, which we may call the passage beds between No. II and No. III. These beds held between the two walls of Trap and Trias, have been attacked by hot acid waters flowing into them, dissolving away the carbonates of lime and magnesia, and leaving behind in a concentrated mass the insoluble silicates and hydrated peroxide of iron, converted much of it into magnetic oxide.

"The whole mass of ore is distinctly stratified, and shows the process of concentration. The original insoluble matters in the lime-shale still remain in the ore. The stratification of the ore mass is perfectly regular, but almost unchanged white crystalline limestone beds lie interstratified in the midst of it, showing that some of the original strata had a mineral composition not susceptable to a change into ore. These limestones lie in their original places among the other strata which have been changed into ore. But they have been subjected to merely enough change to convert them into an inferior kind of marble. The rest of the ore strata were first no doubt charged with hydrated peroxide of iron (brown hematite): but the change went on one step further; the water was driven off, and the oxide of iron was crystallized into magnetic iron ore, still retaining all the impurities of the original lime-shale beds.*

---

* In the chapter referring to the magnetic limonites of Dillsburg, York County, Pa., which are similar in character to Cornwall ore, Prof. Lesley further states that "They have all been changed from the condition of a hydrous peroxide to that of an anydrous sesquioxide by the heat of the dikes. How far the trap has introduced iron (with copper) from below, or how far the action of the trap has been limited to segregating the iron distributed in the sedimentary strata, cannot be dogmatically stated. The prime fact is, that the region of these mines is a belt of country covered now, or once covered, by the Trias formation, the special (but not exclusive) region of trap outflows."

"The remarkable features of this ore mass are: First, the quantity of sulphur which it contains; and secondly, the universal distribution of a small percentage of copper through the whole mass of ore; and its concentration into strings and plates of native copper only in the upper part of the mass where attempts were made at one time to obtain it in sufficient quantities to make it marketable; but the richest pockets of it at the top of the hill were soon exhausted, and none others have been met with lower down."

In a paper read February 18, 1886, at the Pittsburg meeting of the American Institute of Mining Engineers, by Mr. E. V. d'Invilliers, of Philadelphia, who had been in charge of the State Geological Survey of the Cornwall Ore Mines, is given a very interesting and scientific description, illustrated with maps and sectional views. It is also accompanied by a photographic plate of a model of the Ore Hills made by Mr. Ambrose E. Lehman, C. E., (a former Lebanonian and a member of our Society). This model was very ingeniously constructed by Mr. Lehman from surveys made by Mr. W. F. Shunk and Mr. d'Invilliers, and is composed of a series of layers of cardboard, each layer representing one ten-foot contour-curve line. Mr. Lehman, who also constructed Topographical models of the Cumberland Valley and of the Gettysburg Battle Field, (which by the way are very artistic and unique), read a very interesting paper at the Halifax meeting of the A. I. M. E in September, 1885, on the construction of these Topographical models, and to him must be given the credit of having been one of the pioneers in the construction of relief maps now in general use in this country. In referring to the location and the stratification of the ore deposit as well as to its original formation Mr. d'Invilliers says:

"The situation of the ore-mass in the great limestone valley and surrounded on three sides by a formation of lime-shale (to be described further on) would render it probable that it was originally a formation of lime-shales containing more or less magnesia, silica, alumina and iron pyrites. This probability is increased by the laminated stratification, and is made fairly certain by the fact that a considerable thickness of unchanged lime-shale layers, passing upward into solid beds of hard limestone, blue, white and semi-crystalline, is exposed along the southern side of Middle Hill, in the body of the ore-mass, which has been mined on both sides of them, beneath and above them. These unchanged lime-shale beds are seen at one place resting upon the ore; and at another place the limestone beds dip under the ore layers at the same angle, changing gradually, both longitudinally and vertically, into ore.*

"In addition to these facts, there occurs on the 650' terrace the remarkable exposure of sandstone and conglomerate already referred to, which must be regarded as interstratified with the ore-mass. This rock extends through a range of 10 feet of the ore vertically, 100 feet long and 20 feet wide. But so far, it has not been met with elsewhere in the mine. It must be a part of the original stratification of the ore-mass, for fully 50 feet of the ore have been quarried from its surface. Two of these blocks still stick up out of the wide terrace, awaiting the westward advance of mining development to dislodge them. They could get into the ore-deposit in no known way, and no rocks in the neighborhood bear any resemblance to them.

"If, as has been suggested by Prof. Lesley, a resemblance can be established between these rocks and similar isolated masses found in some of the large brown-hematite mines of the State, it would be so much in evidence, that, however formed at first, 'the Cornwall magnetic iron-mass is as sedimentary a formation as the brown-hematite ore-masses in other parts of the State, and that it was like them, a formation of magnesian limestone beds, some thick and hard, others very thin, laminated, soft, and easily acted upon by water.' Prof. Lesley moreover remarks, that the magnetic quality of the Cornwall ore does not invalidate such a conclusion; for Dr. Genth found minute crystals of magnetic iron ore in the limonites of Centre county. He also found that some of the limonites had parted with a portion of their water of hydration. Both of these facts indicate a beginning of a change of the brown-hematite ore bodies from their condition of hydrated peroxide (limonite) toward that condition of anhydrous sesquioxide (magnetite) to which we find the whole body of the Cornwall ore to have been already brought.

---

* In 1899 the Cornwall ore Bank Company sank a number of test holes, by means of a Diamond Drill, about 600 feet south of the Middle and Grassy Hills and under the red sandstone formation at a varying depth found a solid body of unstratified limestone overlying the iron ore.

"Beds of bluish-white limestone, some of them a fair white marble, crop at several places in the mine, in knobs and ridges, in such a way as to show that they are regularly interstratified with the ore-mass, left in an unchanged condition, while the ore has been mined away around them. And this is one of the strongest proofs of the original stratification of the whole deposit.

"In texture and color they resemble the limestone of the Lebanon Valley quarries, and the thin lime-shale beds in the railroad cuts north of Cornwall. They must belong to the great limestone formation No. II, of the valley, or to the transition layers between the Siluro-Cambrian limestone and the overlying Hudson river slates, No. III."

Relative to the magnetic qualities of the Cornwall ore, Mr. d'Invilliers further states:

"It may be safely concluded, that the Cornwall ore deposit has experienced three stages of development: being originally a formation of (pyritiferous) lime-shales; then a great brown-hematite formation; and finally a magnetic ore deposit always retaining its original place and general stratification, but becoming consolidated by the loss of most of its lime and magnesia, all of its water of crystallization, and part of its oxygen, and greatly reduced in bulk, without the loss of its original grains of sand (such as are very visible in the brown-hematite ores, and with a concentration of its percentage of iron.

"What the original percentage of iron was, is open to conjecture. In some brown-hematite mines the beds change to carbonate of iron below the drainage-level: in others, especially the pipe ores of the Nittany Valley in Central Pennsylvania, I have seen cores of sulphuret of iron left unchanged in the centre of the limonite masses. It is, however, difficult to ascribe the production of the Cornwall magnetic ore-mass to the dissolving action of cool running water on the lime-shales, which is all that is required to produce the brown-hematite deposits.

"But at Cornwall, Wheatfield, Reading, Boyertown, and Dillsburg, the five chief localities in Pennsylvania where this character of ore has been found, trap-dikes are always present in the general border range of the Mesozoic formation. It is quite possible therefore to account for the magnetic stage of development in these ores by the resulting action of heat, either direct through the lava of the trap-dikes, or indirectly by the agency of boiling spring waters."

The chemical constitution of the Cornwall ore is variable in the different strata. The heavier commercial ore containing as much as 65 per cent. of metallic iron, with a gangue composed of about 4 per cent. of silica and 2½ per cent. of bases, consisting of lime, magnesia and alumina, while other commercial ore runs as low as 35 per cent. of iron, with from 20 to 25 per cent. of silica and from 15 to 20 per cent. of bases:—a fair average of the ore producing about 48 per cent. of metallic iron in the blast furnace.

Sulphur, copper and phosphorous are all constant but variable constituents of Cornwall ore:—the sulphur being in the form of pyrites,—the average run of mine containing from 2 to 3 per cent. This entails the additional expense of calcining or roasting the ore in kilns especially constructed for that purpose,—by which process, the sulphur in the ore is reduced to from 0.5 to 0.8 of one per cent. before being smelted in the blast furnace.

As before stated, the copper in the ore occurs principally in the form of pyrites, although it is occasionally found in the form of carbonates, and red oxide, and will average from 0.4 to 0.5 of one per cent. in the run of the mine.

Phosphorous varies from .007 to .025 of one per cent., and is sufficiently low, to make Cornwall iron both available and desirable for making Bessemer Steel.

At the office of the Ore Bank Company, there are six blocks of cubes of ore, embracing four different grades, dressed to measure a cubic foot each, but as they are not perfectly homogenous, their weight and the percentage of iron contained in them are not proportionable.

The following shows the grade and weight of each cube, together with its percentage of iron, viz:

No. 1,	1st	grade,	weighs	224	lbs,	contains	62	per	cent.	iron.
" 2,	2nd	"	"	257	"	"	57	"	"	"
" 3,	"	"	"	257	"	"	55	"	"	"
" 4,	3rd	"	"	228	"	"	44	"	"	"
" 5,	"	"	"	231	"	"	42	"	"	"
" 6,	4th	"	"	199	"	"	24	"	"	"

This grading, which was made for the purpose of classifying the analysis, does not represent the grading by which the ore is sold, as that is only divided into two grades, without reference to any fixed unit of value.

The following is an analysis of the average run of the mine, viz:

Metallic Iron,	- -	48.00	per	cent.
Copper,	- - -	0.50	"	"
Manganese,	- -	0.10	"	"
Silica,	- -	12.50	"	"
Lime,	- -	3.50	"	"
Magnesia,	- -	6.00	"	"
Alumina,	- -	3.00	"	"
Sulphur,	- -	2.00	"	"
Phosphorous,	- -	0.006	"	"

Under the agreement of 1787, up to the year 1849, the joint owners each mined the ore as best suited his purpose.

Different mine-holes or openings on the ore hills were occupied and worked by the several owners, without disturbing each other, and frequently, mine-holes or openings were exchanged by master miners for mutual convenience.

The quantity of ore mined, however, was comparatively small, as it was only used by about half a dozen charcoal furnaces belonging to the several owners of the mines, and no accounting to each other for the ore mined and taken away, was required.

The building of the Lebanon Furnaces in 1846-7, which used anthracite coal for fuel, as well as the building of other anthracite furnaces on the Schuylkill and the Susquehanna, rivers and at Cornwall, a few years later, greatly increased the demand for ore, and as there were no restrictions on its sale, each individual owner sold as much as he chose, and at whatever prices were obtainable, without accounting to the other joint owners.

On the 30th day of March, 1848, however, an agreement was entered into by the principal owners of the ore banks, in which they agreed to account to each other for all ore taken by them respectively.

This agreement was not adhered to, and its violation resulted in a lengthy and almost interminable Suit in Equity, that was begun in 1851, and was only ended in 1869.

It was a battle of giants among the legal fraternity, and all who took part have since passed to "the great beyond."

The local attorneys engaged were Messrs. John Weidman, Levi Kline, John W. Ulrich, Amos R. Boughter, and Josiah Funck.

Among the others, (some of whom had a National reputation), were James L. Reynolds and Clement B. Penrose, of Lancaster; Jeremiah S. Black, of York; John C. Kunkel and John H. Briggs, of Harrisburg; Francis W. Hughes, of Pottsville; William Strong, of Reading, afterwards a Justice of the U. S. Supreme Court; and Messrs. R. C. McMurtrie, George M. Wharton, George W. Biddle, and E. Spencer Miller, of Philadelphia.

This suit resulted in the formation of the "Cornwall Ore Bank Company," on the first day of February, 1864, which has assumed and controls all mining operations, (except for Robesonia Iron Co.), as well as full accountability to the joint owners, through their General Superintendent of Mines, which position is ably filled by Mr. J. Taylor Boyd, who has been the General Superintendent since the formation of the company.

It is impossible to state the correct amount of ore already mined and taken away, as no record of mining operations from the time of the discovery of the mines, up to the year 1848, are obtainable, and it is doubtful if any accounts were kept, outside of the Blast Book records of the different furnaces using the ore, and many of these have been lost and destroyed.

The quantity can however be gotton at approximately, by considering the number of furnaces supplied from time to time, and charging each with using 2,000 tons per annum, (which is a liberal allowance), and dividing the time into two periods, from 1742 to 1790, and from 1790 to 1848,—after which time complete records have been kept.

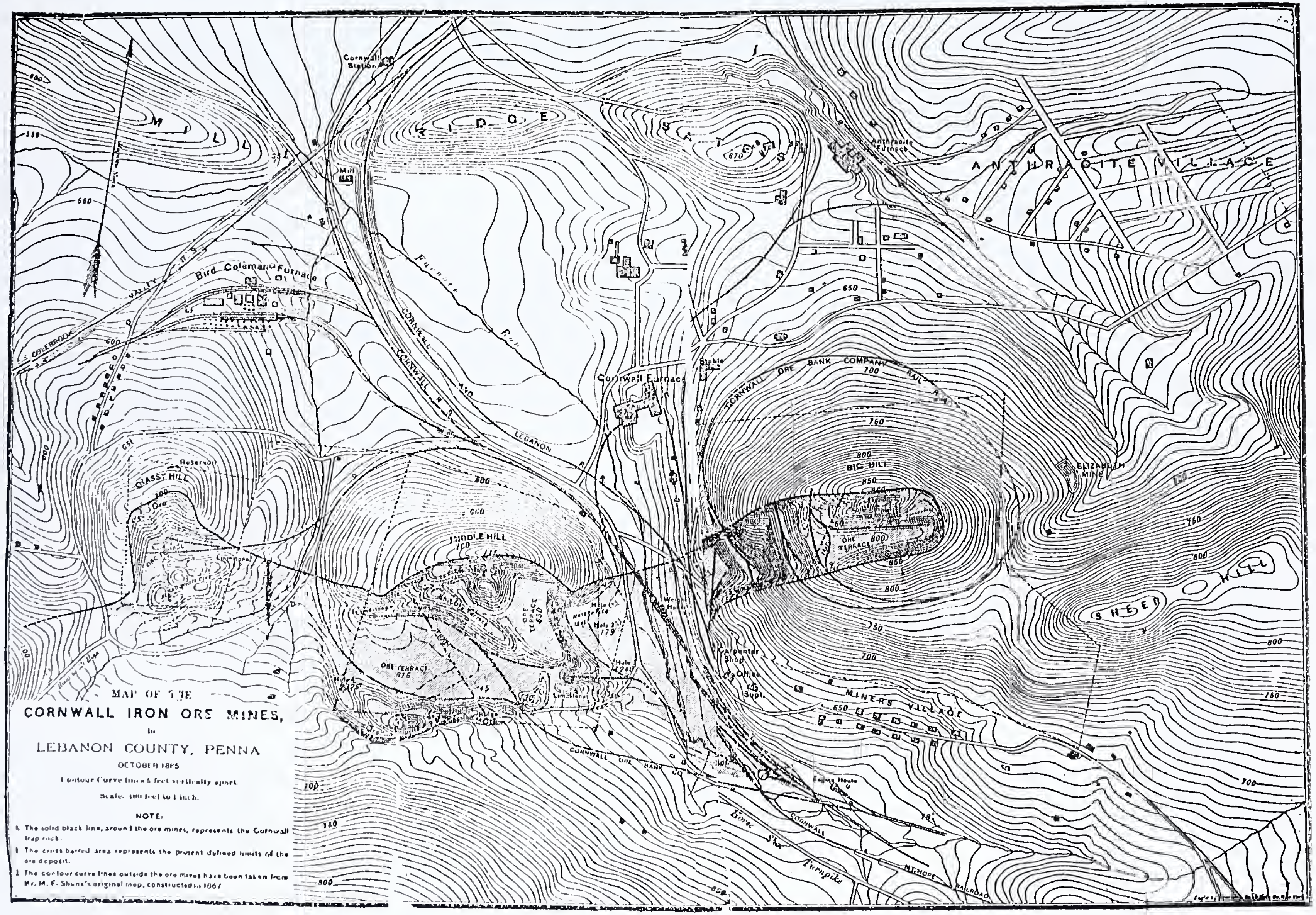
Cornwall Furnace used from	1742 to 1790,	48 yrs,	96,000 tons
Elizabeth " " "	1750 " "	40 "	80,000 "
Mt. Hope " " "	1785 " "	5 "	10,000 "
Total, - - -			186,000 tons

Cornwall Furnace used from	1790 to 1848,	58 yrs,	116,000 tons
Elizabeth " " "	" " "	" "	116,000 "
Colebrook " " "	1791 " "	57 "	114,000 "
Mt. Hope " " "	1790 " 1803,	13 "	26,000 "
" " " " "	1821 " 1848,	27 "	54,000 "
Reading " " "	1794 " "	54 "	108,000 "
Mt. Vernon " " "	1801 " 1814,	13 "	26,000 "
" " " " "	1844 " 1848,	4 "	8,000 "
Manada " " "	1837 " "	11 "	22,000 "
Total, - - -			590,000 tons

Quantity of Ore mined from 1848, to the formation of The Cornwall Ore Bank Company, February 1, 1864, - - -	1,524,908 tons
Quantity of Ore mined from February 1, 1864, to January 1, 1900, - - -	13,281,263 "

RECAPITULATION.

Quantity of Ore mined prior to 1790, -	186,000 tons
Quantity of Ore mined from 1790 to 1848, -	590,000 "
Quantity of Ore mined from 1848 to 1864, -	1,524,908 "
Quantity of Ore mined from 1864 to 1900, -	13,281,263 "
Grand Total, - -	15,582,171 tons



MAP OF THE

CORNWALL IRON ORE MINES,

in

LEBANON COUNTY, PENNA

OCTOBER 1885

Contour Curve lines 5 feet vertically apart.

Scale. 400 feet to 1 inch.

NOTE:

1. The solid black line, around the ore mines, represents the Cornwall trap rock.
2. The cross barred area represents the present defined limits of the ore deposit.
3. The contour curve lines outside the ore mines have been taken from Mr. M. F. Shunk's original map, constructed in 1867.

12/21/2007
118458 E 68 00
HF GROUP-IN